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NOTES ON THE SNAKE GENUS TRIMORPHODON

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THERE are 13 forms definable at present in the colubrid genus *Trimorphodon*. These very readily fall into two groups of six or seven forms each, one characterized by presence of large, V-shaped marks on head and neck (*biscutatus* group), the other characterized by a transverse, light nuchal collar of varying width (*upsilon* group). The forms contained in the *biscutatus* group are *biscutatus biscutatus*, *b. quadruplex*, *paucimaculatus*, *lyrophanes*, *lambda*, and *vandenburghi*. The members of the *upsilon* group are *latifascia*, *fasciolata*, *upsilon*, *collaris*, *tau*, *vilkinsonii*, and *forbesi*. These two groups form natural assemblages that certainly are of subgeneric rank.

In *Trimorphodon*, as in many other genera of snakes, evolution has produced but few morphological innovations, and those that have been produced are evident almost universally in terminal species that appear to have been recently differentiated from a generalized stock. Evolution in this genus has been evidenced chiefly in pattern; this is the basic medium of speciation. Accordingly, differences in species are to be sought primarily in the pattern, only secondarily in morphology. Likewise, relationships and direction of evolution must be traced through pattern changes, not by morphological variations.

Fortunately many of the steps in pattern evolution are shown or indicated by species yet extant. The most important steps of all, however—those that link the two radically different head and neck patterns of the two groups—are lacking completely, and are not even

indicated by variants of the several species. Only by sheer guesswork can the process of divergence of these two types from some common prototype be imagined.

Evolution within each group is relatively clear, and follows amazingly parallel trends.

In the *biscutatus* group are two closely related sections, of which *quadruplex* is the most primitive of one, *paucimaculatus* of the other. Of these two species, the latter exemplifies a more primitive pattern, but both have large blotches and identical ventral counts, and they differ from each other only in subcaudal counts and in extent of subdivision of the blotches. In *paucimaculatus* the spots are very broad but are divided only across the middle by a light streak or spot; in *quadruplex* they are also divided medially, but the light streak has completely split each blotch, and each of the resulting spots is again split medially, so that superficially *quadruplex* very strongly appears to have double the normal complement of blotches of the group.

Modification of the pattern of *quadruplex* resulted in the development of *biscutatus*. This form differs from *quadruplex* only in its pattern, which appears to have been produced by suppression of the alternate blotches of *quadruplex*. That this was the procedure is indicated by the fact that (1) the primary blotches in the northern form are widely separated and number about half as many as in *quadruplex*; (2) the spaces between the blotches in *biscutatus* are frequently occupied by narrow, interrupted dark bands, which occasionally are of the same shape as the primary blotches (more or less H-shaped, light-centered); and (3) these "secondary" bands (suppressed primary blotches), if enlarged to the size and character of the primary bands, would reproduce the pattern of *quadruplex*.

The same process apparently has been followed in the section including *paucimaculatus*, with the production of *lyrophanes*, *lambda*, and *vandenburghi*. The most primitive pattern type among the derivatives of *paucimaculatus* is, curiously enough, that of *vandenburghi* (structurally the most highly modified species of the genus), which represents a phase intermediate between *paucimaculatus* and *lyrophanes*. To explain, the first step beyond the pattern type of the former is the production of quadruple blotches, or, in other words, double the usual number of primary blotches (as in *quadruplex*). The next step is suppression of alternate blotches; in *vandenburghi* about half have been suppressed (and accordingly the number of blotches is distinctly higher than in *paucimaculatus*). In *lyrophanes* nearly all alternating blotches have been suppressed, and secondary bands are made evident between the primary blotches; sometimes one or two of the alternate blotches are not completely suppressed but

remain evident as very small blotches. In *lambda* the process of suppression is complete; the secondary bands are scarcely evident.

Obviously this succession of pattern types (*paucimaculatus* to *vandenburghi* to *lyrophanes* to *lambda*) is not to be considered as an indication of a similar succession in species evolution, for the morphology here shows otherwise. Certainly *lyrophanes* and *vandenburghi* have been isolated for a long period from *paucimaculatus*, since in them has been developed a spineless (i. e., very minute



FIGURE 37.—Diagram of the possible phylogeny of *Trimorphodon*.

spines) hemipenis. For some reason pattern change in *vandenburghi* ceased or greatly slowed, and perhaps through its influence *lyrophanes* did not reach the stage of complete suppression of alternate blotches that characterizes *lambda*. The latter, of course, did not have the retarding influence of *vandenburghi*; and presumably its genetic (and geographic) differentiation from *paucimaculatus* was made complete at an early date—very likely at the time the *lyrophanes-vandenburghi* stock was isolated.

This accounts for the *biscutatus* group. The record is not so clear for the *upsilon* group, which has members with more highly modified patterns than the former but (with one exception) without special morphological peculiarities. In this group two primitive forms are still living—*latifascia* and *fasciolata*—of which the former has perhaps the most primitive pattern. Both of these species have very large, few blotches. In distribution they are peripheral to the central plateau of Mexico. In relation to other members of the group these two stand in much the same position as *paucimaculatus* and *quadruplex* do in relation to other members of the *biscutatus* group. However, it is difficult to reconstruct so plausibly the process by which other members of the *upsilon* group were derived from *latifascia* and *fasciolata*; suffice it to remark that their patterns may have evolved by a splitting and suppression process much like that which occurred in the *biscutatus* group.

Evolution within the *upsilon* group is made most apparent by changes in the head pattern. The two most primitive types have none, or only a poorly indicated interocular light bar. The least modification in other species is found in *tau*, in which the interocular light bar is generally complete, and an indentation of the dark head color along the parietal suture is evident. *T. collaris* reproduces this head pattern, and with *tau* delimits an extensive geographic range completely peripheral to the central plateau. Since increase in number of blotches seems to be the trend in the *upsilon* group, *collaris* with few, broad blotches is conceived to be more primitive than *tau*. It is noteworthy that the opposite extreme (from *collaris*) in number of blotches in *tau* occurs in Michoacán, which is also the farthest extreme from *collaris* geographically.

The central-plateau species, *upsilon*, was obviously derived from *tau* or its near ancestor, as its head pattern, with a Y-shaped parietal mark, is clearly derived from that of *tau*. In number of blotches it remains very similar to the latter.

The end form in the *upsilon* group is *vilkinsonii*, in which are apparent the extremes in reduction of head pattern and of body blotches. The latter is not evidenced by trends in other species of the group, although it is generally the case that multiplication in number of blotches is followed by a decrease in their size. The simple 3-spot head pattern of juvenile *vilkinsonii*, however, is the end result of the general trend, observed in other species, toward enlargement of the light areas of the head and consequent reduction in size of the dark areas.

The body pattern of *vilkinsonii* is highly suggestive of the pattern of *Lampropeltis leonis*, which is fairly certainly known to have been derived by suppression of alternate blotches. This similarity at

least suggests the possibility that *vilkinsonii*'s pattern was produced in the same manner. The multiplicity of blotches in certain central (Guanajuato?) specimens of *upsilon* is an apparent step in this direction. Possibly specimens from areas between Zacatecas and Chihuahua would show whether such a course may have been pursued in the evolution of *vilkinsonii*.

In view of the fact that several morphological changes took place in the *biscutatus* group, with differences apparent in subcaudals, hemipenis, and anal plate, it is remarkable that only one species in the *upsilon* group possesses morphological characters sufficiently dif-

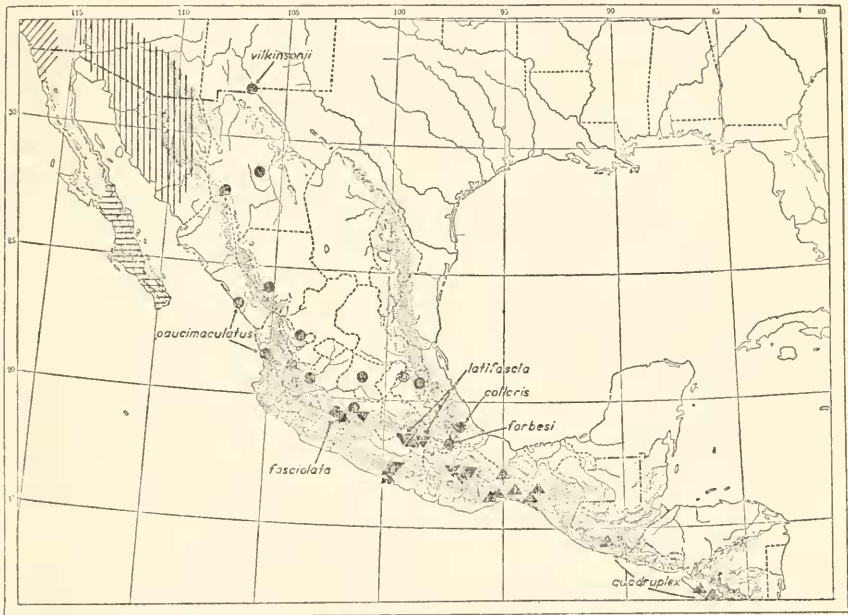


FIGURE 38.—Distribution of the species of *Trimorphodon*. Inverted triangles, *tau*; triangles not inverted, *b. biscutatus* (unless otherwise indicated); dots, unless otherwise indicated, *upsilon*; vertical cross hatching, *lambda*; horizontal cross hatching, *lyrophanes*; diagonal cross hatching, *vandenburghi*.

ferent from the group norm to identify it. This species (*forbesi*) is very much like *upsilon* in pattern, and its apparently recent development tempts a chronological association with the development of the species in the other group with a single anal (*vandenburghi*).

With respect to pattern, it is noteworthy that, curiously, the end form in neither group has undergone sufficient morphological differentiation that it may thereby be distinguished from the members of the group to which it belongs.

The relative age of the two groups is difficult to determine. One group (*biscutatus*) appears to be of lowland origin, while the other

appears to be of highland origin. Accordingly, the fact that the *biscutatus* group may have a Central American, or at least a more southerly, origin does not necessarily mean that the *upsilon* group is a derivative of it, since it occurs toward the north in the general direction of migration of the *biscutatus* group. In fact, the connection between the two groups is so remote that, were morphological characters available, they would better be separated as different genera.

KEY TO THE GENUS TRIMORPHODON

1. Large V-shaped marks on head and nape..... 2
No such marks; a transverse nuchal collar (or whole neck light, as in *vilkinsonii*)..... 7
2. Anal entire..... *vandenburghi*
Anal divided..... 3
3. Light V-shaped mark, which involves parietals, not confluent posterolaterally with light color (or white) of ventral surface, but *cut off by* the continuation posteriorly of *the black band* that on the head precedes the light band.
lyrophanes
Light mark extending posterolaterally direct to ventral surface, or at least not cut off laterally by the preceding dark band..... 4
4. Ventrals less than 245; blotches on body relatively numerous (maximum 34), about as broad as long, not connected laterally in pairs (nor such a connection indicated)..... *lambda*
Ventrals more than 245; blotches on body numerous or few, but if the former, connected laterally in pairs (or such a connection indicated).... 5
5. Blotches on body numerous (about 33), connected laterally in pairs.
biscutatus quadruplex
Blotches on body less numerous (25 or less)..... 6
6. Blotches more than twice as long as spaces between; no evidence middorsally of secondary bands or blotches..... *paucimaculatus*
Blotches less than twice as long as spaces between; usually secondary bands or blotches present middorsally on some part of body.
biscutatus biscutatus
7. Anterior dorsal blotch covering 15 or more scale lengths on middorsal line, involving seven or more ventrals; blotches usually gray or black..... 8
Anterior dorsal blotch covering 13 or fewer scale lengths middorsally, involving fewer than seven ventrals..... 9
8. Blotches little narrower laterally than dorsally, much broader on belly than interspaces..... *fasciolata*
Blotches much narrower laterally than dorsally, on belly equal to or narrower than white interspaces..... *latifascia*
9. Blotches very narrow, a third length of interspaces; anterior border of first dorsal blotch 9 or 10 scales behind parietal..... *vilkinsonii*
Blotches broader, little if any narrower than spaces between; anterior border of first dorsal blotch farther forward, not more than six scales behind parietal..... 10
10. Fifth and six labials entering orbit; anterior loreal split, an upper and lower; tail white, unmarked, below..... *forbesi*
Fourth and fifth labials entering orbit; anterior loreal single; tail marked below or not..... 11
11. Bands on body 16..... *collaris*
Bands on body 22 or more..... 12

12. A roughly Y-shaped mark on parietals, the arms forking just behind frontal, the mark usually enclosed by dark color posteriorly; belly with some, subcaudal surface with numerous dark marks; blotches on body 23 to 32.

upsilon

No similar mark on head; dark color of head sharply truncate near posterior edge of parietals, with a narrow or broad, light indentation along parietal suture ----- tau

This study was completed, and a number of specimens on which it is based was collected, during my tenure of a Walter Rathbone Bacon Traveling Scholarship of the Smithsonian Institution. I am much indebted to Dr. E. H. Taylor and L. M. Klauber for the loan of numerous important specimens and for invaluable advice and criticism, without which the study would have been impossible.

Genus TRIMORPHODON Cope

TRIMORPHODON PAUCIMACULATUS Taylor

Trimorphodon paucimaculatus TAYLOR, Kansas Univ. Sci. Bull., vol. 24, pp. 527-529, pl. 46, fig. 1, 1936 (1937) (Mazatlán, Sinaloa); *ibid.*, vol. 25, p. 360, pl. 35, fig. 3, 1938 (1939).—KLAUBER, Trans. San Diego Soc. Nat. Hist., vol. 9, p. 185, 1940.

Diagnosis.—Large V-shaped marks on head, these not continued on neck but disappearing laterally just behind head; hemipenis long, with a middle belt of enlarged spines; ventrals 251 to 253, caudals 76 to 84; anal entire; blotches on body 20 to 25, a little more than twice as long as spaces between; secondary bands reduced to small lateral spots, not extending dorsally; tail blotches 10 to 13.

Specimens examined.—Two, including type.

Locality records.—Mazatlán and Presidio, Sinaloa; San Blas, Nayarit (U. S. N. M. No. 46617).

Remarks.—The San Blas specimen is in very poor condition but can be seen to have very broad blotches; it has 84 caudals.

This species, I believe, possesses the pattern of the ancestral type of *lambda*, *lyrophanes*, and *vandenburghi*, which I interpret as being direct derivatives of it. It is, moreover, near the ancestral type of the whole group, since it is a little less specialized, in pattern, than the direct ancestor (*quadruplex*) of the other member of the group (*biscutatus*).

TRIMORPHODON LAMBDA Cope

Trimorphodon lambda COPE, Proc. Amer. Philos. Soc., vol. 23, pp. 286-287, 1886 (Guaymas, Sonora).—TAYLOR, Kansas Univ. Sci. Bull., vol. 25, pp. 360-361, pl. 35, fig. 4, 1938 (1939).

Trimorphodon lyrophanes KLAUBER, Trans. San Diego Soc. Nat. Hist., vol. 9, pp. 181-187 (part), 1940.

Diagnosis.—Large V-shaped marks on head, these not continued on neck but disappearing laterally just behind head; hemipenis long,

with a middle belt of spines; ventrals 243 or less, caudals 86 or less; anal entire; spots on body 34 or less.

Specimens examined.—Twelve, including type.

Locality records.—Various localities in California, Nevada, Utah, Arizona, and Sonora (Klauber, *op. cit.*, p. 187).

Remarks.—The hemipenis of a specimen from Guaymas, Sonora (EHT-HMS No. 4572) is more than 16 caudals long (a portion everted, dried); three large frounces cover the length of about 11 caudals; an area of spines covers a length of about five caudals, proximal to area of frounces.

Another specimen from Telegraph Pass, Summit of Gila Mountains, Yuma County, Ariz. (L. M. Klauber, No. 25488) has a hemipenis 22 caudals long; three large frounces, extending to the thirteenth caudal from base, passing *through* an area of enlarged spines covering the length of three caudals; remainder ridged, with tiny spicules. The spinous area in this specimen includes the proximal ends of the frounces, from the fourteenth to the sixteenth caudal inclusive; in other words, the spines begin about seven caudals from the distal tip. This is different from the condition in the Guaymas specimen, but there seems to be a similar variation in position of the spinous area in other species.

TRIMORPHODON LYROPHANES (Cope)

Lycodon lyrophanes COPE, Proc. Acad. Nat. Sci. Philadelphia, vol. 12, p. 343, 1860 (Cape San Lucas, Baja California).

Trimorphodon lyrophanes COPE, Proc. Acad. Nat. Sci. Philadelphia, vol. 13, p. 297, 1861.—TAYLOR, KANSAS UNIV. Sci. Bull., vol. 25, p. 363, 1938 (1939).—KLAUBER, TRANS. SAN DIEGO SOC. NAT. HIST., vol. 9, pp. 181-187 (part), pl. 7, fig. 2, 1940.

Diagnosis.—Large V-shaped marks on head, these continued onto neck, not terminating laterally behind head; hemipenis relatively short, without enlarged spines; ventrals less than 243; anal divided.

Specimens examined.—Nine.

Locality records.—Various localities in Baja California: Cape San Lucas, San José del Cabo, Santa Anita, Miraflores, Sierra San Lázaro, Todos Santos, La Paz, Santa Rosalia, San Ignacio (Klauber, *loc. cit.*).

Remarks.—The present species differs most markedly from *lambda* in the character of the hemipenis, which is spineless (*i. e.*, without enlarged spines) and shorter in *lyrophanes* (as in *vandenburghi*), while in *lambda* it is longer and with spines (as in all other *Trimorphodon*). Three hemipenes dissected in situ on specimens from Baja California agree well with the description of the extruded hemipenis of *vandenburghi* given by Klauber (*op. cit.*, p. 170), with the exception that there are but three large frounces (instead of four);

an additional, smaller, terminal flounce is not readily discernible in noneverted hemipenes). In addition it may be observed that the hemipenis is 16 to 20 caudals long (in situ) and that the flounces are relatively small, near the tip, and cover a length equal to the length of four or five caudals.

Specimens examined show constant differences in head and neck pattern from *lambda*. In *lyrophanes* the dark, V-shaped mark (which extends nearly or quite to a line even with posterior border of orbits) extends posteriorly onto the neck, without a break; in *lambda* it extends posterolaterally and terminates a little posterior to the labials, about even with a line drawn back from the lip. The light band posterior to this dark band in *lyrophanes* continues onto the neck and terminates with a large neck blotch, or else its arms unite posteriorly and may pierce the neck blotch posteriorly; in *lambda* this mark extends posterolaterally and usually unites with the white of the ventral surface.

A difference in the character of the dorsal blotches in *lyrophanes* and *lambda* is evident to the eye but is not well suited to measurement. The blotches are narrower and longer in *lyrophanes*, and fairly well severed from their lateral extensions; they are broader and shorter in *lambda*, and their lateral extensions are not so strongly differentiated.

TRIMORPHODON VANDENBURGHI Klauber

Trimorphodon vandenburghi KLAUBER, Bull. Zool. Soc. San Diego, No. 1, pp. 17-18, fig. 3, 1924 (Wildwood Ranch, 1,520 feet, 5 miles southwest of Ramona, San Diego County, Calif.); Trans. San Diego Soc. Nat. Hist., vol. 5, pp. 183-194, pls. 22, 23, 1928; vol. 9, pp. 169-180, pl. 7, fig. 1, 1940.

Diagnosis.—Large V-shaped marks on head, these usually not continued on neck; hemipenis short, without spines; ventrals 244 or less; anal entire.

Specimens examined.—One.

Locality records.—Numerous localities in southern California (see Klauber, *op. cit.*, 1940).

Remarks.—A single hemipenis examined in situ agrees with the description given by Klauber (*op. cit.*, 1940, p. 170), with the exception that only three flounces are discernible (instead of four). In addition, the hemipenis is 14 caudals long and the flounces are relatively small, as in *lyrophanes*.

This very distinct species appears to be directly related to *lyrophanes*. Its chief difference from the latter—the entire anal—is an amazing development in a genus with so few structural variations.

TRIMORPHODON BISCUTATUS QUADRUPLEX, new subspecies

Holotype.—U. S. N. M. No. 89476, female, Esteli, Nicaragua, collected by J. H. Ivy in 1932.

Paratypes.—U. S. N. M. No. 5569, Realejo, Nicaragua; No. 6805, Guatemala; No. 32274, San Juan, Nicaragua.

Diagnosis.—A member of the *biscutatus* group, with large V-shaped marks on head; dark blotches completely divided, each of practically all the resulting sections again partially split medially; counted separately, blotches 33 (pairs numbering 17); ventrals 251 to 263; total counts 334 to 347.

Description of holotype.—Supralabials 9-9, fourth and fifth entering orbit, third smallest, fifth (or sixth) largest; three preoculars, upper largest, in contact with frontal; three large loreals, the smallest lowermost and directly above third supralabial; three subequal postoculars; three anterior temporals; infralabials 13-13, 4-5 in contact with chin shields.

Dorsals in 25-26-17 rows, with two apical pits, those on posterior third of body convex or bluntly keeled; ventrals 261; anal divided; caudals 82.

Maxilla with 11 teeth, the last two grooved, offset from others, slightly shorter than longest anterior teeth, preceded by a short diastema; other teeth separated from each other by equal spaces, decreasing in size posteriorly; anterior smaller than succeeding teeth, which are the largest of maxilla; tooth preceding fangs half length of latter.

Hemipenis (of No. 32274) 25 caudals long; flounces three, large, covering a length equal to between seven and eight caudals; about 70 enlarged spines in a small area (length of four caudals) proximal to flounces.

General color gray; a dark-brown, black-edged bar extending across top of head a little in front of eyes, anterior edge of frontal about in its middle; this followed by a light bar which extends diagonally onto sides of head, reaching labial border at eighth and ninth labials; this followed by a broad, V-shaped black mark, terminating laterally even with mouth, split by a longitudinal white line on middorsum; this followed by a somewhat narrower V-shaped light mark, extending laterally to ventral surface; following this, a similar V-shaped dark mark, but this prolonged posteriorly and uniting with first blotch, enclosing medially a long, broad, light line; this blotch is the first of a series of 33 brownish-gray, dark-edged blotches, many of which are joined in pairs, most with a light, broad, transverse median area which nearly divides them; sides of body with a series of small, irregular spots, one placed between alternating spots (i. e., between the pairs); ventral surface stippled, a little more posteriorly than anteriorly; ends of about every other or every third, occasionally of two adjacent ventrals dark brown; chin and gular region immaculate; ventral surface of tail a little more heavily stippled than body.

Variation.—The paratypes available are in such poor condition that the number of blotches cannot be counted, but they are of the same nature as in the type. The scale characters of Nos. 5569, 6805, and 32274, respectively, are: Scale rows 25–25–17,?, 23–25–?; ventrals 255, ?, ?; caudals 92 (♂), 93 (♂), 90 (♂); supralabials 9–9, preoculars 3–3, postoculars 3–3, in all; infralabials 13–14, 13–14, 12–13; loreals 3–3, 2–3, 2–3; preoculars separated from frontal on one side in one.

Comparisons.—The present form differs from *biscutatus* solely in the extent of subdivision of the blotches, which in this are very complex, consisting of two halves (each of which appears like the primary blotches of *biscutatus*), which again are partially divided. For practical purposes of separation from *biscutatus*, the blotches may be considered separately, whereby the number secured is much greater than the number of primary blotches in *biscutatus*.

TRIMORPHODON BISCUTATUS BISCUTATUS (Duméril and Bibron)

Dipsas biscutata DUMÉRIL and BIBRON, *Erpétologie générale*, vol. 7, p. 1153, 1854 (Mexico).

Trimorphodon major COPE, *Proc. Amer. Philos. Soc.*, vol. 11, p. 153, 1869 (Tehuantepec).

Diagnosis.—Large V-shaped marks on head; dorsal blotches 18 to 23 on body, separated from one another by a distance at least a little greater than half their own length (usually equal or greater); a secondary, transverse, broken, narrow, black band between each pair of primary blotches (rarely reduced to lateral spots; in this case the primary blotches do not close the large space between the primary blotches); ventrals 251 to 275; caudals 81 to 102; total counts 343 to 376.

Specimens examined.—Twenty-four.

Locality records.—Acceptable records are from the Isthmus of Tehuantepec (Santa Efigenia, El Barrio, Tres Cruces, Tehuantepec, Cerro Guengola, La Concepción) in the State of Oaxaca; Tonalá and San Ricardo in Chiapas; Huajintlán, Morelos; Agua del Obispo, Organos, Acapulco, and La Crucita, Guerrero; and Hda. El Sabino and 10 miles north of Tafetán, Michoacán.

Remarks.—A specimen from Tehuantepec has a hemipenis 24 caudals long; flounces 3, large, covering a length equal to about 7 caudals; area of spines covering a length of 4 or 5 caudals.

As pointed out by Taylor,¹ northern specimens have higher average ventral and caudal counts than southern specimens. Present specimens are insufficient, however, to show whether the differences are significant and practically recognizable. The counts are given in table 1.

¹ Kansas Univ. Sci. Bull., vol. 24, pp. 358–360, 1929.

TABLE 1.—Scale counts of *Trimorphodon biscutatus biscutatus*

No.	Sex	Ventrals	Caudals	Totals	State
23619	♂	260	100	360	Michoacán.
5339	♂	267	95	362	Do.
5338	♂	269	101	370	Do.
110410	♂	275	100	375	Guerrero.
5508	♂	265	-----	-----	Do.
21404	♂	275	85	360	Do.
4588	♂	270	100	370	Do.
5145	♂	275	101	376	Do.
5146	♂	274	99	373	Do.
5147	♂	272	99	371	Do.
5148	♂	272	102	374	Do.
30406	♂	252	91	343	Oaxaca.
30427	♂	260	94	354	Do.
30428	♂	-----	90	-----	Do.
30429	♂	260	85	345	Do.
46547	♂	260	85	345	Do.
110404	♂	263	81	344	Do.
110405	♂	251	94	345	Do.
110406	♂	255	94	349	Do.
110407	♂	255	96	351	Do.
110409	♂	268	-----	-----	Chiapas.
110403	♂	271	88	359	Oaxaca.
110408	♂	269	90	359	Do.
4589	♂	261	85	346	Chiapas.

TRIMORPHODON LATIFASCIA Peters

Trimorphodon biscutata latifascia PETERS, Monatsb. Akad. Wiss. Berlin, 1869, p. 877 (Puebla).

Trimorphodon latifascia TAYLOR, Kansas Univ. Sci. Bull., vol. 25, pp. 364-365 (part), pl. 36, fig. 2, 1938 (1939); vol. 26, p. 479, pl. 52, 1940.

Diagnosis.—A light, transverse nuchal collar; hemipenis long, with a median belt of spines; blotches very long, 13 to 15 on body, 5 to 7 on tail, the first covering 15 or more scale lengths middorsally; number of ventrals involved by each dark band slightly more to half number involved by adjacent light areas.

Specimens examined.—Ten.

Locality records.—"Puebla" (perhaps the region of Matamoras); 12 miles south of Puente de Ixtla, Morelos; Huajintlán, Morelos; between Cuernavaca and Tepoztlán, Morelos.

Remarks.—Hemipenis (EHT-HMS No. 5540, Huajintlán, Morelos) 28 caudals long (in situ), with three large flounces extending 10 caudal lengths proximally, followed by an area of enlarged spines about three caudals long; remainder with longitudinal ridges surmounted by tiny spines.

TRIMORPHODON FASCIOLATA, new species

Holotype.—U.S.N.M. No. 110400, male, from near Zaráracua Falls, 6 kilometers southeast of Uruapan, Michoacán.

Diagnosis.—A member of the *epsilon* group, having a transverse, light nuchal collar; dorsal bands few (13 in type), little narrower on sides than on middorsal line, and much longer ventrally than light spaces between; ventrals 219, caudals 76, scale rows 23, in type; no interocular light bar.

Description of holotype.—Supralabials 8 or 9, fourth and fifth entering orbit on one side, third also on other; two large loreals and on one side a third small loreal at posterolateral border of second loreal; preoculars 2 or 3, upper somewhat the largest and in contact with frontal; three postoculars, median somewhat the smallest; three anterior temporals, followed by three secondary temporals on one side, four on other; 12 infralabials, six in contact with chin shields, five with anterior pair; posterior chin shields separated medially, narrower and shorter than, and about two-thirds the size of anterior chin shields.

Scales in 21–23–15 rows, smooth, with paired apical pits; scales above anus slightly convex; ventrals 219; caudals 76; anal divided.

Maxilla with 10 teeth, in four groups; three anterior teeth, the anterior smallest of the three and subequal in size to ungrooved teeth in other groups, the posterior somewhat larger than second, which is very nearly as large as posterior grooved teeth; one tooth in second group, about size of first tooth, separated from other teeth on either side by a short but very evident diastema; four teeth follow, smallest of the maxilla, very slightly decreasing in size; two posterior teeth enlarged, offset, separated by a distinct diastema (subequal in length to other diastemata) from preceding teeth.

Hemipenis long (25 caudals), slender (not everted); proximal third with numerous ridges capped by very minute, scarcely discernible spines; adjacent sixth with about 50 small spines, which extend to the middle of the hemipenis; distal half without spines, ridged, with three large flounces, which have tiny papillae on their free edges; distal half with tiny papillae; tip with somewhat larger papillae, apparently not bifurcate; sulcus single.

Top of head dark, with numerous tiny light flecks, no trace of regular markings except a median, V-shaped mark posteriorly, apex forward; sides of head more light than dark, top of head more dark than light; nuchal collar white, with some dark stippling, its posterior border nearly straight, somewhat concave, a little more than two scale lengths behind parietals medially; anterior border of nuchal collar vague, grading into darker color of head, especially laterally. Thirteen very broad, dark cross bands on body, four on tail; first five bands covering 19 to 21 scale lengths medially, remaining bands decreasing in length posteriorly; first five bands covering 15 to 18 scale lengths on first scale row, remaining bands fewer, but all bands

covering about three-fourths as many scale lengths laterally as on middorsal line; each dark band with a narrow, broken, transverse white line dividing it into two halves; spaces between bands white, covering one and one-half to two and one-half scale lengths medially, all except the anterior three and nuchal collar enclosing laterally a small dark spot, which involves two scales of the first scale row and the end of the ventral scale between them; dark bands encroaching on ventral surface, the median and posterior completely encircling body, although with numerous light flecks on midventral surface; numerous dark flecks on venter between posterior bands; ventral surface of tail irregularly mottled with light and dark; chin immaculate.

Comparisons.—This species most closely approaches *latifascia* Peters, as defined by the specimens reported by Taylor.² One of these is described as having the first four bands covering 19, 15, 16, 16 scales (first five covering 19 to 21 in *fasciolata*), but they are distinctly narrower laterally, involving 7 to 9 ventrals, while the white areas between involve 9 or 10 (dark bands involve 13 to 17, light bands 6 ventrals in *fasciolata*).

TRIMORPHODON UPSILON Cope

Trimorphodon upsilon COPE, Proc. Amer. Philos. Soc., vol. 11, p. 152, 1869 (Guadalupe; type, U.S.N.M. No. 31358).—TAYLOR, Kansas Univ. Sci. Bull., vol. 25, pp. 365–366, pl. 35, fig. 2, 1938 (1939).

Diagnosis.—A light, transverse nuchal collar; head largely dark, but with a light interocular bar and a Y-shaped light mark on parietal region, the arms of which fork immediately behind frontal; 23 to 32 body blotches, 11 to 15 tail blotches.

Specimens examined.—Twelve.

Locality records.—Known from the central, southern, and northwestern plateau region. Recorded from the States of Chihuahua (Batopilas), Durango (Ventanas); Guanajuato; Hidalgo (Zacualtipan; 10 km. north of Jacala); Jalisco (Cumbre de los Arrastrados; Guadalajara; Magdalena); Michoacán (Tacícuaro); Nayarit (Sierra de Nayarit); Zacatecas (San Juan Capistrano).

Remarks.—The dorsal bands of a specimen observed in life (from Magdalena, Jalisco) were reddish brown; the color and general character of the rhombs resembled to some extent those of certain *Lampropeltis*.

The ventral surface in this species is distinctly marked with irregular black spots; the subcaudal surface is more heavily blotched than the belly. A single exception is a somewhat faded, soft speci-

² Kansas Univ. Sci. Bull., vol. 25, pp. 364–365, pl. 36, fig. 2, 1939; vol. 26, p. 479, pl. 52, 1940.

men evidently preserved just before shedding, so the color is greatly obscured (No. 12419, Guadalajara); another specimen, nearly perfect, from the same locality, has the whole ventral surface very heavily pigmented. In this respect *upsilon* differs from typical specimens of *tau*, *collaris*, *forbesi*, and *vilkinsonii* and agrees with *fasciolata* and *latifascia*.

The hemipenis of a specimen from "Mexico" (with 30 body blotches) is 26 caudals long; three large frounces, covering the length of eight caudals; area of spines covering the length of four caudals.

In general there appears to be an increase in number of body blotches toward the east. Western specimens (three from Guadalajara, and Magdalena, Jalisco) have the fewest (23, 24, 25), while specimens from eastern localities (Guanajuato, Hidalgo, Zacatecas) have 27 to 32.

TRIMORPHODON FORBESI, new species

Holotype.—U.S.N.M. No. 110402, male, from San Diego (about 5 miles south of Tehuacán), Puebla, collected by Dyfrigg McH. Forbes.

Diagnosis.—A transverse nuchal collar, heavily suffused dorsally with dark pigment, so that the first dorsal band is more or less confluent with the dark head color; belly very light, dark markings dim; no markings on ventral surface of tail; bands on body 21, the first five covering 13, 8, 9, 10, 10 scale lengths, respectively; nine supralabials, fifth and sixth entering orbit; anterior loreal divided; a large light area on head, including posterior portions of supraocular and frontal, and more than half (anterior) the parietals, indented posteriorly by a dark area, which reaches nearly to the posterior tip of frontal.

Description of holotype.—Frontal as high as wide, portion visible from above a little longer than its distance from prefrontals, as long as internasals; latter two-fifths as large as prefrontals; length of frontal equal to its distance from tip of snout; nasal completely divided, anterior section somewhat smaller than posterior; anterior loreal wedged between internasals and prefrontals, divided into an upper and lower part; a large posterior loreal; on one side a small subloreal, making a total of three loreals on one side, four on other; three preoculars; three postoculars, middle smallest, lowest largest; temporals 3-4-5; supralabials nine, fifth and sixth entering eye, fourth smallest, sixth perhaps largest; infralabials 12, five in contact with anterior chin shields, two with posterior; first infralabial largest; anterior chin shields twice size of posterior.

Dorsal scales smooth, with two apical pits, in 23-23-16 rows; supra-anal scales convex; ventrals 213; anal divided; caudals 77. Total length 818 mm.; tail 150 mm.

Hemipenis 23 caudals long; three large flounces, covering eight caudal lengths; area of spines covering four caudal lengths.

Color.—Dorsal color very light brownish gray, lighter in vertebral region; 21 rhombs on body, 11 on tail; rhombs light brown, with a slightly reddish tinge; a narrow black border on each rhomb, the borders not extending below about the third scale row; rhombs extending to ventral scales; first five rhombs covering 13, 8, 9, 10, 10 scale lengths, last five 6, 5, 6, 6, 7 scale lengths, respectively (on mid-dorsum); spaces between rhombs about equal to three scale lengths middorsally; on first scale row rhombs cover only one or two scale lengths; a series of very small, lateral spots alternating with the rhombs, these involving the lower part of the first scale row and the ends of the ventrals, each spot covering an area about equal to the size of three lateral scales.

Ventral surface of body nearly white; lateral spots encroaching upon venter, but very subdued, as are all other dorsal markings where they reach the venter; ventral surface of tail white, immaculate.

General tone of head color gray-brown; snout light gray, stippled; this color extending in a wide band along the prefrontal suture to frontal; latter band with a black border extending a little anterior to middle of prefrontals, posteriorly continuing onto corner of frontal and then curving onto supraocular; area enclosed by these dark borders on the frontal is dark, confluent with a *dark* interocular bar, which is black-edged posteriorly, passes through the middle of the supraocular and occupies the same position as the usual interocular *light* bar; posterior to this a narrowly black-edged, extensive light area, which occupies the posterior half of frontal, posterior portion of supraoculars, and anterior half of parietals; this light area notched posteriorly, the dark edge curving sharply forward nearly to tip of frontal; posterior and lateral to this is a darkly suffused area, which medially extends to the anterior border of the first dorsal rhomb; nuchal light collar present; its posterior border nearly straight (anterior edge of first rhomb), but the collar itself very dim, due to the dark dorsal suffusion; sides of head gray; posterior supralabial region suffused with pink.

Remarks.—One of the most remarkable features of this snake is the peculiar head pattern, which is, in general, much like that figured for *tau* (Taylor, *op. cit.*, 1940, fig. 8), except that the dark area of the frontal and parietals is *light*, although just as distinctly outlined; the dorsal nuchal area, light in *tau* (and in all other members of the *upsilon* group) is dark in *forbesi*; the interocular light bar, characteristic of the entire group, is dark in *forbesi*.

It appears that a pattern reversal has taken place; whether it is an anomaly in the single type or is characteristic of the species can-

not now be stated. It is remarkable that the reversal of pattern begins anteriorly precisely at the frontal-prefrontal suture; anterior to this suture the head pattern is normal, with a light snout and a light, longitudinal median line with darker sides; posterior to this suture the light color is very sharply changed to dark, and vice versa, with the exception of the black borders, which outline the markings and which remain constant.

While the head pattern of *forbesi* is very different from that of other species of the group, it cannot be considered in differentiation of the species from *upsilon*, since there is a strong possibility it may be anomalous. There are numerous other unique characters in *forbesi*. No specimens of other species of *Trimorphodon* of the *upsilon* group have the anterior loreal divided; and no other of that group has the fifth and sixth labials entering the eye. These characters, combined with a faintly marked belly and white, unmarked subcaudal surface (*upsilon* has the belly, and especially the tail, distinctly dark-mottled); number of rhombs (fewer than in *upsilon* and *tau* with a minimum of 23, and more than in *collaris* with 16); narrow black borders of the rhombs (broad in *tau*, possibly in *collaris*); length of rhombs on middorsal line (as long as in *collaris*, longer than in *tau* or *upsilon*); all define a species very different from any other of the *upsilon* group.

The closest relative of *forbesi*, I believe, is *upsilon*; the general appearance of the dorsal rhombs is much the same. The elimination of the ventral markings and lightening of the dorsal markings may be compared with the same tendency in other deserticolous reptiles which develop a faded pattern. The remarkable changes in cephalic scutellation bring to mind a somewhat similar, recent change in *vandenburghi* of the other (*biscutatus*) group, in which a single anal is developed. Neither of these two species is otherwise greatly (although somewhat) different from its closest relative.

The type is from a semiarid region. So far as known *upsilon* is restricted to more humid areas.

TRIMORPHODON COLLARIS Cope

Trimorphodon collaris COPE, Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 8, p. 131, 1875 ("Orizaba").—SUMICHRAST, La Naturaleza, vol. 6, p. 14, 1882.

Trimorphodon latifascia TAYLOR (part), Kansas Univ. Sci. Bull., vol. 25, pp. 364-365, 1938 (1939).

Diagnosis.—A light, tranverse nuchal collar; an interocular light bar; snout light; 16 bands on body, the longest covering 13 scale lengths middorsally, eight on venter; spaces between blotches covering four and one-half to six scale lengths middorsally.

Specimens examined.—The only one known, the type (U. S. N. M. No. 26499).

Locality records.—Described from "Orizaba," but doubt is cast upon this locality by the presence of two different labels (in the same handwriting) with the type, both stating "Tehuantepec" as the locality. Sumichrast, the collector, states that "the typical individuals came from Tuxpango, near Orizaba" (*loc. cit.*).

Remarks.—In the absence of well-differentiated scale characters in the group, color differences must be relied upon to distinguish various species. It is true the type of *collaris* has nine labials, as do *latifascia* and *fasciolata*, but this of itself means very little, since occasional specimens of *upsilon* also have nine. I have considered *collaris* distinct from *latifascia* because (1) the bands are considerably smaller on the middorsal line (13 scale lengths, maximum), and the intervening spaces cover four and one-half to six scale lengths; and (2) there are distinct head markings, including sharp differentiation of head pattern from nuchal collar, latter encroaching upon parietals, interocular light bar evident, a light bar evident along internasal and prefrontal suture, and snout white. These characters place it in the section with *upsilon*.

Essentially the only difference between this and *upsilon* is the small number of blotches (16) on body. The minimum in *upsilon* is 23 (specimen from Guadalajara, Jalisco, type locality).

This is the only specimen of the genus that has ever been taken on Atlantic slopes, at least in Mexico.

TRIMORPHODON TAU Cope

Trimorphodon tau COPE, Proc. Amer. Philos. Soc., vol. 11, p. 152, 1869 ("Tehuantepec," in error).—SUMICHRAST, La Naturaleza, vol. 6, p. 14, 1882.—TAYLOR, Kans. Univ. Sci. Bull., vol. 25, pp. 365-366, pl. 35, fig. 2, 1938 (1939); vol. 26, pp. 464-477, pl. 51, fig. 8, 1940.

Diagnosis.—A light nuchal collar; an interocular light bar indicated; an indentation posteriorly of black head cap, but no Y-shaped head mark behind frontal.

Specimens examined.—Five.

Locality records.—Quiótepec (U. S. N. M. No. 30338, type), San Felipe (EHT-HMS No. 5507), and Oaxaca (EHT-HMS No. 5506), all in the State of Oaxaca; 7 miles east of Chilpancingo, Guerrero (EHT-HMS No. 23417); and between Morelia and Hidalgo, Michoacán (EHT-HMS No. 21402).

Remarks.—The type locality of this species is not Tehuantepec, as stated by Cope, since Sumichrast (*loc. cit.*) states, "I found the type of this species near Quiótepec, between Tehuacán and Oaxaca."

The primary difference between *tau* and *upsilon* is in head pattern. In the former the dark head color is abruptly truncate near the posterior tips of the parietals, and a light indentation (broad or narrow) is visible along the parietal suture. In *upsilon* the dark head

color is not so abruptly truncate posteriorly, terminating posterior to the parietals; and the light, midparietal indentation of *tau* is replaced by a narrow, Y-shaped mark, the arms of which follow near the posterior sutures of the frontal, and sometimes reach to the outer edge of the supraoculars, where they join with the tips of the interocular light bar.

Variation in body pattern in *tau* is so great that no contrast of the species as a whole with *upsilon* is possible. The variants of *tau* appear to be segregated geographically but are represented by so few specimens that the apparent differential characters of the three populations indicated may not be well founded.

The range of *tau* is apparently the periphery of the central Mexican plateau. The extreme southern records near Oaxaca city, in the isolated mountains of central Guerrero, and in the mountains at the extreme edge of the plateau in Michoacán all indicate such a peripheral distribution. All three loci represented by specimens, however, are so far removed from each other that the peculiarities of each population (two of which are represented by single specimens) may prove to have special significance: that is, at least three subspecies may exist in *tau*:

1. OAXACA specimens (3). Dorsal blotches 23 to 26; tail bands 9 to 10; belly very little pigmented; subcaudal surface nearly uniform white; interocular band complete; nuchal blotch two to three scale lengths behind parietal; body blotches (except two nuchal ones) involving three or fewer scales in first row, average two.

2. GUERRERO specimen (1). Dorsal body blotches 22; tail blotches 8; belly heavily pigmented, the dorsal bands visible (not sharply defined); subcaudal surface very strongly mottled; interocular band reduced to a round spot in middle of frontal; nuchal blotch five scale lengths behind parietal; body blotches (except two nuchal) involving two to six scales in outer row, average five.

3. MICHOACÁN specimen (1). Dorsal body blotches 34; tail bands 11; belly with some dark spots, poorly defined; subcaudal surface moderately pigmented; interocular band complete; nuchal blotch one scale length behind parietal; body blotches not well defined on outer scale rows, involving two or three scales on outer row where visible.

TRIMORPHODON VILKINSONII Cope

Trimorphodon vilkinsonii COPE, Proc. Amer. Philos. Soc., vol. 23, pp. 285-286, 1886 (Chihuahua).—TAYLOR, Kansas Univ. Sci. Bull., vol. 25, pp. 361-363, fig. 1, pl. 38, 1938 (1939).—KLAUBER, Trans. San Diego Soc. Nat. Hist., vol. 9, pp. 187-189, 1940.

Diagnosis.—A broad, light area on neck, between dark areas on head and first body blotch; bands a third length of interspaces; dark head area only three spots in young.

Specimens examined.—One, the type, U. S. N. M. No. 14268.

Locality records.—Chihuahua and El Paso, Tex.

Remarks.—This species obviously is a close relative of *upsilon*, from which it differs chiefly in the narrowness of the dark bands, which are a third as broad as the spaces between them.